

4.3 Logarithmic Differentiation

$$\frac{d}{dx} (x^2 + 1)^{\sin x} \quad \left. \vphantom{\frac{d}{dx} (x^2 + 1)^{\sin x}} \right\} y = (x^2 + 1)^{\sin x}$$

$$\ln y = (\sin x)(\ln(x^2 + 1)) \quad \ln y = \sin x \ln(x^2 + 1)$$

$$\frac{1}{y} \left(\frac{dy}{dx} \right) = (\cos x)(\ln(x^2 + 1)) + (\sin x) \left(\frac{1}{x^2 + 1} (2x) \right)$$

$$\frac{dy}{dx} = y \left[(\cos x) \ln(x^2 + 1) + \frac{2x \sin x}{x^2 + 1} \right]$$

5.1) if f is continuous

$f'(x) > 0$ means $f(x)$
is increasing

$f'(x) < 0$ means $f(x)$ decreasing

$$3.5/17) \frac{d}{dx} 4 \cos^5 x$$

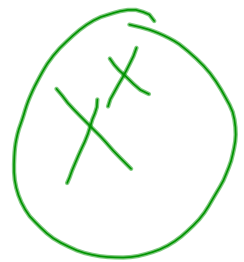
$$= \frac{d}{dx} (4 (\cos x)^5)$$

$$= 4 \left[5 (\cos x)^4 (-\sin x) \right]$$

$$\exp(x) = e^x$$

4.3 logarithmic differentiation

$$y = (x^2 + 1)^{\sin x}$$



$$\ln y = \sin x \ln(x^2 + 1)$$

$$\frac{1}{y} \frac{dy}{dx} = (\cos x) (\ln(x^2 + 1)) + (\sin x) \left(\frac{2x}{x^2 + 1} \right)$$

$$\frac{dy}{dx} = y \left[(\cos x) (\ln(x^2 + 1)) + \frac{2x \sin x}{x^2 + 1} \right]$$

5.1) f continuous

f increasing $f'(x) > 0$

f decreasing $f'(x) < 0$

$$f(x) = \sin x$$

$$f'\left(\frac{\pi}{3}\right) = \lim_{x \rightarrow \frac{\pi}{3}}$$

$$\dots - f'(x) = \cos x \quad f'\left(\frac{\pi}{3}\right) = \cos\left(\frac{\pi}{3}\right)$$

$$\frac{\sin x - \sin \frac{\pi}{3}}{x - \frac{\pi}{3}}$$

$$f'(x_0) = \lim_{x_1 \rightarrow x_0}$$

$$\frac{f(x_1) - f(x_0)}{x_1 - x_0}$$

Write the limit defⁿ of derivative
of $\sin x$ at $x = \frac{\pi}{3}$

$$\lim_{h \rightarrow 0} \frac{[2(x+h)^2 + 3(x+h)] - 2x^2 - 3x}{h}$$

$$f(x) = 2x^2 + 3x$$

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

Power Rule

$$\frac{d}{dx}(x^n) = n x^{n-1}$$

Exponential

$$\frac{d}{dx}(n^x) = (n^x)(\ln n)$$

